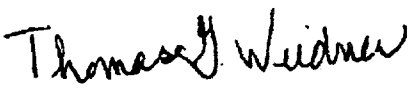
SLAP Lesion of the Glenohumeral Joint: pathology, evaluation, surgery, rehabilitation, and recovery.

An Honors Thesis (HONRS 499)

by

Tim Lentych

Dr. Tom Weidner, PhD, ATC/L



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SLAP lesion of the Glenohumeral Joint: Pathology, evaluation, surgery, rehabilitation, and recovery.

Tim Lentych, ATS; Dr. Thomas Weidner, PhD, ATC/L

Objective:

To review the pathology, evaluation, surgery, rehabilitation, and recovery of a SLAP lesion. Discuss a case study reviewing the process of a SLAP lesion from the time it was first diagnosed until the later stages of rehabilitation.

Data Sources:

Information was obtained from cross-referencing pertinent articles and books on labral tears or SLAP lesions.

Data Synthesis:

The clinical presentation of superior labral lesions often includes repetitive overuse in athletes that play over head sports, especially baseball. Labral lesions are associated with complaints of pain and clicking or popping in the shoulder. The diagnosis can be difficult, and often misinterpreted as rotator cuff tendinitis, biceps tendinitis, bursitis, or inflammation of the biceps tendon sheath.

Conclusions/Recommendations:

Labral tears are a relatively new source of shoulder pain and disability in throwers. Knowledge about a SLAP lesion and the essential components will help in identifying the causes for this particular injury. Labral tears are usually managed with surgery and an extensive rehabilitation program.

Key Words: labral tear, biceps tendon, glenohumeral joint

Acknowledgments:

Many thanks to Dr. Tom Weidner, my thesis advisor, for his role in this process. His comments and criticism offered insight which was a valuable part in completing this project. Other thanks to Dr. Andrews, Kevin Wilk, Gary Schmidt, Mitch Bibb, and the Baltimore Orioles for the information and further advancing my knowledge of this topic.

The glenohumeral joint is a complex joint which can be put through numerous stresses creating problems among athletes. Problems with the shoulder occur in practically every sport activity, but is often seen in baseball where momentum of the arm changes rapidly as in the act of throwing.[1] Baseball produces an array of shoulder injuries not seen in other sports. The dynamic process of throwing involves numerous muscles, tendons, and bones that can be stressed and cause injury to the shoulder. One injury that is seen in baseball players is called the SLAP lesion. SLAP stands for superior labral anterior-to-posterior.[1] A SLAP lesion is a unique and unusual entity. Causes of this condition are related to congenital or physiologic laxity (overuse).[1] It is important to understand that a SLAP lesion not only affects the glenoid labrum but the anatomy around it as well. The purpose of this paper is to describe the involvement of the labrum and other structures of a SLAP lesion starting from the pathology to surgery, rehabilitation, and ending in recovery.

Functional Anatomy

Bone Structures

The shoulder joint is comprised of numerous joints and muscles which work as a highly synchronous unit to produce around 16,000 different positions.[2] The joint involves four main bony structures which acts together to provide the greatest range of motion of any other joint in the human body. The four bony structures involved in the shoulder include the sternum, clavicle, scapula, and the humerus. Each of the four structures make up a joint that is part of the shoulder girdle.[3]

Glenohumeral Joint

The most important joint which involves a SLAP lesion is the glenohumeral joint (GH).

This joint is formed by the head of the humerus articulating with the glenoid fossa of the scapula. The GH joint is inherently unstable because of the relationship in the sizes of the articular surfaces of the glenoid fossa and the humeral head.[3] A normal shoulder precisely contains the humeral head to within one to two millimeters of the center of the glenoid cavity.[4] The stabilizing effects lie between the labrum, capsulolabral ligaments and enhanced by the surrounding muscles. These stabilizing structures produce a concavity compression effect directed towards the glenoid center.[4] The small relationship between the glenoid fossa and the humeral head resembles a ball-n-socket joint. The GH joint is supported or reinforced by the glenohumeral ligaments and the coracohumeral ligaments.[3]

The glenohumeral ligaments produce three separate bands. The inferior band possesses an anterior and posterior band with a hammocklike structure connecting the two.[3] The superior and middle ligaments of the joint, known as the foramen of Weithrecht, is a weak site on the capsule that is often torn.[3] As a group, the glenohumeral ligaments limit external rotation and anterior displacement of the humeral head on the glenoid fossa. The coracohumeral ligament merges with the superior capsule and the supraspinatus tendon and limits extension and flexion of the GH joint. Much of the weight of the arm is supported by the superior glenohumeral ligament and the inferior portion of the glenoid labrum (see Appendix A).[3]

Humerus

The humerus is the largest and longest bone of the upper body.[3] Half of the humerus is an attachment site for many tendons. Some important bony landmarks include the head of the humerus, greater tuberosity, bicipital groove, lesser tuberosity, and proximal humeral shaft. The head of the humerus is inclined relative to the shaft at the anatomical neck at an angle of 130 to

150 degrees and is retroverted 26 to 31 degrees from the medial and lateral epicondylar plane (see Appendix B).[4]

Scapula

The scapula is a large, thin, triangular bone lying on the posterior part of the body, overlying ribs 2 through 7.[4] This bony landmark also serves as an attachment site for muscles. Certain landmarks on the scapula that are important for these attachment sites include the coracoid process, spine, acromion process, and the glenoid fossa. The spine separates the supraspinatus muscle from the infraspinatus and extends laterally to the base of the acromion. The coracoid process projects anteriorly from the upper border of the scapula. The glenoid fossa represents the bony articulating surface for the humerus (see Appendix C).[3]

Soft Tissues
Labrum

The labrum is a dense, fibrous structure which deepens the socket of the shoulder.[4] It increases the surface area and adds stability to the socket. The labrum also enhances stability by deepening the concavity of the glenoid socket, an average of nine millimeters and five millimeters in the superoinferior and anteroposterior planes, respectively.[4] The importance of a SLAP lesion in relation to the labrum, is the biceps tendon attaches to the anteroposterior and superoinferior areas of the labrum.[4] The anteriosuperior and superior portion of the labrum are less vascular, which in turn may have implications of improper healing potential of the superior labrum (see Appendix D).[4]

Biceps Tendon

The biceps tendon consist of two heads.[3] The long head originates directly into the

superior portion of the labrum and supraglenoid tuberosity. The short head originates from the coracoid process. They both insert on the bicipital tuberosity of the radius. The long head of the biceps is located between the supraspinatus and subscapularis tendons. Action of the biceps tendon consist of extension of the humerus, flexion of the elbow, and it also assists with abduction of the humerus (see Appendix E).[3]

Throwing Mechanics

There are five distinct phases of throwing.[5] Phase one is the wind-up phase. This phase is a relatively slow motion that prepares the pitcher for correct posture and balance. With correct posture and balance the shoulder will go into the cocking phase with form and ease. The acceleration and deceleration forces during this phase are quite minimal.

Phase two is the cocking phase which applies maximal tension to all the muscles that will be used during the acceleration phase. In this phase, the shoulder is abducted at 90 degrees and the shoulder is externally rotated. This places a stress on the anterior capsule and the internal rotators of the shoulder. The shoulder will then advance forward to the acceleration phase through a smooth well controlled process.[5]

Phase three is the acceleration phase which begins with deceleration and ends just prior to when the ball is released. Energy is developed by the body moving forward from the cocking phase which then is transferred to the throwing arm to produce acceleration. Enhancement of the energy is generated by the internal rotators from the previous cock position which effects the acceleration of the ball to be delivered.[5]

Phase four is the deceleration or release phase. This phase produces forces which are two times as great as the acceleration forces. At the moment of ball release the arm has been

accelerated to its maximum velocity, and must now be decelerated to stabilize the glenoid cavity.[5] As the arm comes forward into the deceleration phase, the biceps tendon is stretched. When the tendon is stretched it is working against other muscles, like the rotator cuff, to stabilize the humeral head. If the tense biceps tendon becomes overstretched it can drag the labrum off into the joint, avulsing the origin of the tendon. The athlete may or may not relate any type of feeling or onset of symptoms. The athlete will feel pain or feel a click or snap when the individuals arm is in the act of throwing. If the biceps tendon and the rotator cuff muscles do not decelerate, it may cause a SLAP lesion.

The last phase is the follow-through phase. In this phase the body moves forward with the arm, reducing the distraction forces applied to the shoulder and relieving tension on the rotator cuff muscles.[5] The lower extremity controls the balance and posture from the deceleration phase to help the recovery of the shoulder and prevents it from injury (see Appendix F).[3]

Pathology

During the act of throwing, the biceps tendon stretches downward on the superior labrum in an attempt to hold the humeral head in place.[1] Acting with the biceps tendon, the rotator cuff muscles in particular the supraspinatus attempt to stabilize the humeral head within the joint. Due to the force or momentum of the arm, a traction injury may occur to the rotator cuff muscles or biceps tendon.[1] The force may cause the biceps tendon to pull off from the insertion on the labrum thus causing a SLAP lesion. The initial pathology occurs during the fourth phase or deceleration phase.

Most of the injuries to the shoulder occur during the acceleration and deceleration phases because of the amount of stress placed on the shoulder. If the muscles of the shoulder are not

well conditioned, it can cause some instability of the glenohumeral joint. Furthermore, it can damage the structures in the glenohumeral joint or the surrounding musculature.[1] SLAP lesions can be evaluated as other common injuries of the shoulder. Some related conditions include symptoms of tendinitis, pain along the biceps tendon, inflammation of the biceps tendon sheath, and rotator cuff tendinitis. The primary symptoms of a SLAP lesion are the intermittent catching, snapping, and microinstability of the shoulder.[1]

Once detected a SLAP lesion can be divided into 4 distinct types.[4] Type I SLAP lesion has degenerative fraying of the superior labral edge, which remains firmly attached to the glenoid. Type II lesion, the superior labrum and attached biceps tendon are stripped off the glenoid fossa. Type III lesion involves a bucket-handle tear of the superior labrum, which may or may not displace into the joint. The labrum and the biceps tendon remain intact. Type IV lesion, a bucket-handle tear is present as in type III but with extension into the biceps tendon (see Appendix G).

Evaluation

The key to a correct evaluation is understanding the mechanism of injury and the history of the shoulder. This includes previous injuries, what type of pain, where is the pain located, any snapping or clicking, and any numbness or tingling. Thorough information obtained from the athlete and knowing the anatomy of the shoulder will help with the preliminary diagnoses of the injury. Special tests that are utilized include a Apprehension test, Meister test, positive sulcus sign, Neer sign and Hawkins-Kennedy test, O'Brien test, SLAP lesion test, posterior and anterior laxity, load and shift, speeds, and Yergason tests.[3] These tests produce stress and pain which helps to identify the location of the injury. If further diagnoses is needed the athlete must see the team physician for an X-ray or an MRI on the shoulder. An X-ray determines fractures

and dislocations or any bone abnormality that may be present. It can also detect a soft tissue problems such as joint swelling.[6] Magnetic resonance imaging acquires a detailed picture of the body's soft tissues used to identify specific injuries.[6] After a SLAP lesion is diagnosed surgery is usually recommended.

Surgery

According to Dr. Andrews a surgery procedure is followed to repair a SLAP lesion.[7] First, the athlete is placed in a lateral decubitus position on a bean bag. The arm is in seventy degrees of abduction and fifteen degrees of forward flexion with an Easy Wrap arm holder applied with 15 pounds of traction applied to the upper extremity. Diagnostic arthroscopy is performed with a posterior portal used as a viewing portal and an anterior portal established in the rotator interval just half way between the coracoid process and anterolateral edge of the acromion. A shaver is then used through the anterior portal with visualization to the posterior portal to examine the biceps anchor, superior, anterior, and posterior labrum. In the case of a type II SLAP tear, which involves tearing of the anterior/superior and posterior/superior biceps anchor, a shaver is then placed through the anterior portal and the glenoid margin. Two suture anchors are then placed into the shoulder joint. The first suture is a posterior anchor placed through a small puncture hole along the posterolateral edge of the acromion. Then it is punctured through the rotator cuff, through the posterolateral capsule, and is placed just posterior to the biceps anchor along the posterior/superior glenoid rim. A hole is drilled and tapped to a certain depth where an anchor is then applied.

A suture passing device called a bird beak is then placed through that dome posterior capsular hole. The labrum is grasped and a suture is passed through the labrum in a simple stitch

technique. Both sutures are then pulled out through the anterior cannula and are tied through the anterior cannula using simple stitches with the arthroscopic knot pusher, resulting in a good posterior/superior repair of the SLAP lesion.

A second anchor is then applied using a ROC 2.8 millimeter plastic suture anchor that is drilled through the anterior portal into the anterior/superior glenoid margin. The bird beak or an innovasive 45 degree angle of the suture passer is then used to pass the suture through the labrum in a simple fashion and the labrum is tied down through the anterior portal using either simple stitches or using a sliding knot to slide the number two suture knot down to repair the labrum. This results in a good repair of the anterior/superior biceps anchor resulting in SLAP repair.

Rehabilitation Protocol

According to Dr. Andrews and Kevin Wilk, arthroscopic surgery of a SLAP lesion repair requires an extensive 26 week rehabilitation program.[8] The rehabilitation includes five phases which set out goals and criteria to establish before moving on to the next phase. A interval throwing program is also implemented after the sixteenth week of rehabilitation.

Phase I-Immediate Postoperative Phase "Restrictive Motion" (Day 1 to Week 6)
Goals: Protect the anatomic repair
Prevent negative effects of immobilization
Promote dynamic stability
Diminish pain and inflammation

Week 0-2: Sling for 4 weeks
Sleep in immobilizer for 4 weeks
Elbow/hand range of motion (ROM)
*flexion, extension, supination, pronation, ulnar and radial deviation
Hand gripping exercises
*silly putty and finger squeezes
Passive and gentle active assistive ROM exercises
*Active Assistive ROM exercised are preferred first over passive ROM
1. establish pain-free ROM first

2. increase synovial fluid into the joint
3. increase blood flow
-T-bar, pulley, and pendulums exercises (see Appendix H)
-flexion to 60 degrees
-Elevation in scapular plane to 60 degrees
-External rotation/Internal rotation (ER/IR) with arm in scapular plane
-ER to 10-25 degrees
-IR to 45 degrees
Isometric exercises for the shoulder
*flexion, extension, abduction, ER/IR at 0 degrees (see Appendix I)
No isolated biceps contractions
Cyrotherapy and modalities as indicated

Week 2-4: Discontinue use of sling at 4 weeks
Sleep in immobilizer until week 4
Continue gentle ROM exercises (PROM and AAROM)
*use the T-bar, pulley, and pendulums
-Flexion to 90 degrees
-Abduction to 75-85 degrees
-ER in scapular plane to 25-30 degrees
-IR in scapular plane to 55-60 degrees
No active ER, extension, or elevation
Initiate rhythmic stabilization drills
*start at 90 and 45 degrees while lying supine
Initiate proprioception training
*D1 and D2 patterns (see Appendix J)
Tubing ER/IR at 0 degrees abduction (see Appendix K)
Continue isometric exercises
*flexion, extension, abduction, ER/IR at 0 degrees
Continue use of cryotherapy

Week 4-6: Gradually improve ROM
*use T-bar, pulley, and pendulums
-flexion to 145 degrees
-ER at 45 degrees abduction: 45-50 degrees
-IR at 45 degrees abduction: 55-60 degrees
May initiate stretching exercises
*ER/IR, flexion, horizontal adduction (light)
May initiate light ROM at 90 degrees abduction
Continue tubing ER/IR-0 degrees
PNF manual resistance
*D1 and D2 patterns
Initiate active shoulder abduction

Initiate "full can" exercise
Initiate prone rowing and horizontal abduction exercises
*use tubing
No biceps strengthening

Phase II-Intermediate Phase: Moderate Protection Phase (Week 7-14)
Goals: Gradually restore full ROM (week 10)
Preserve the integrity of the surgical repair
Restore muscular strength and balance

Week 7-9: Gradually progress ROM
*use T-bar and pulley
-flexion to 180 degrees
-ER at 90 degrees abduction: 90-95 degrees
-IR at 90 degrees abduction: 70-75 degrees
Continue to progress isotonic strengthening program
*use free weights and cuff weights for the cuff weight program (see Appendix L)[9]
Continue PNF strengthening
Initiate throwers ten program consist of plyoball and plyometric exercises (see Appendix M)

Week 10-12: May initiate slightly more aggressive strengthening
Progress ER to throwers motion
*use T-bar
-ER at 90 degrees abduction: 110-115 in throwers (week 10-12)
Progress isotonic strengthening exercises
Continue all stretching exercises
*progress ROM to functional demands (overhead athlete)
Continue all strengthening exercises

Phase III-Minimal Protection Phase (Week 14-20)
Goals: Establish and maintain full ROM
Improve muscular strength, power, and endurance
Gradually initiate functional exercises

Criteria to enter Phase III: Full non-painful ROM
Satisfactory stability
Muscular strength
No pain or tenderness

Week 14-16: Continue all stretching exercises
Maintain throwers motion (especially ER)
Continue strengthening exercises

*Throwers ten program consist of plyoball or plyometrics exercises
*PNF manual resistance-D1 and D2 patterns
*Endurance training-treadmill, running, biking, and sprints
*Restricted sport activities-swimming

Week 16-20: Continue all exercise listed above
Continue all stretching
Continue throwers ten program
Continue plyometric program
Initiate interval sport program-throwing
*Interval throwing program (see Appendix N)[9]

Phase IV-Advanced Strengthening Phase (week 20-26)
Goals: Enhanced muscular strength, power, and endurance
Progress functional activities
Maintain shoulder mobility

Criteria to enter Phase IV: Full non-painful ROM
Satisfactory static stability
Muscular strength 75-80% of contralateral side
No pain or tenderness

Week 20-26: Continue flexibility exercises
Continue isotonic strengthening program
PNF manual resistance patters-D1 and D2
Plyometric strengthening
Progress interval throwing program

Phase V: Return to Activity Phase-Months 6 to 9
Goals: Gradual return to sport activities
Maintain strength, mobility, and stability

Criteria to enter Phase V: Full functional ROM
Muscular performance isokinetic
Satisfactory shoulder stability
No pain or tenderness

Exercises: Gradually progress sport activities to unrestrictive participation
*Interval throwing program, flat ground throwing, and mound throwing (see Appendix O)[9]
Continue stretching and strengthening program

Case Report

Personal Data

A 22 year old right hand dominant pitcher complained of pain in his right shoulder. The pain occurred during the deceleration phase of throwing and had been consistent for the past 12 to 14 months. He tried numerous subsequent treatments and rehabilitation with the athletic trainers but there were no improvements with his condition. He also took time off from throwing, but the pain returned when he started throwing again. The athlete has had previous history of right shoulder problems. The previous rehabilitation and treatments improved his condition for only a short period of time.

Physical signs and symptoms

On physical appearance the athlete was a healthy young baseball player. No obvious effusion, erythema, deformity, or protecting or guarding of his right shoulder were present. Palpation of the right shoulder was normal with no tenderness except for tenderness around the insertion of the rotator cuff muscles. Special tests that were performed included: a negative apprehension test, positive Meister test, positive sulcus sign, positive Neer sign and Hawkins-Kennedy test, positive O'Brien test, positive SLAP lesion test, posterior and anterior laxity 2+/1.5+, negative load and shift, speeds, and Yergason tests.

Differential diagnosis

1. Rotator Cuff Tear
2. Rotator Cuff Tendinitis
3. Biceps Tendon Tendinitis
4. Biceps Tendon Tear

Results of diagnostic imaging/laboratory tests

As the symptoms continued, the athlete had to get an MRI on his right shoulder. The MRI results revealed that he had a SLAP lesion of the right shoulder and needed surgery to repair the injury.

Clinical course

The physician diagnosed him with a SLAP lesion. This condition required surgery to suture the biceps tendon to the labrum. Then debris had to be removed from his shoulder. After surgery the athlete had an extensive rehabilitation that consisted of 26 weeks. From week 16 until he pitches in a game, he had to complete an interval throwing program. This program consisted of stages which ranged from different number of feet with increased sets and throws. Then flat ground pitching was implemented with different stages. After the flat ground criteria was met, mound work was performed. The mound work also had criteria in which the athlete had to meet in order to move to pitching in batting practice or game simulation. A maintenance program was implemented along with the extensive interval throwing program. The maintenance program was designed to keep the athlete and the shoulder well conditioned, strong, and stabilized.

Deviation from the expected

This case study is not a unique case. A SLAP lesion has become a new and detected injury to baseball players. Many SLAP lesions are not detected that easy because there are a number of common misinterpretations that include rotator cuff tendinitis, rotator cuff tear, biceps tendon tear, or biceps tendinitis. An MRI can easily detect a SLAP lesion.

Conclusion

Through the combination of my research of a SLAP lesion and having performed

rehabilitation on this type of injury, my knowledge of the shoulder has increased greatly. I am now more competent in proper evaluation procedures for ruling out the common misinterpretations of the shoulder. I can more easily implement a rehabilitation program following a SLAP injury.

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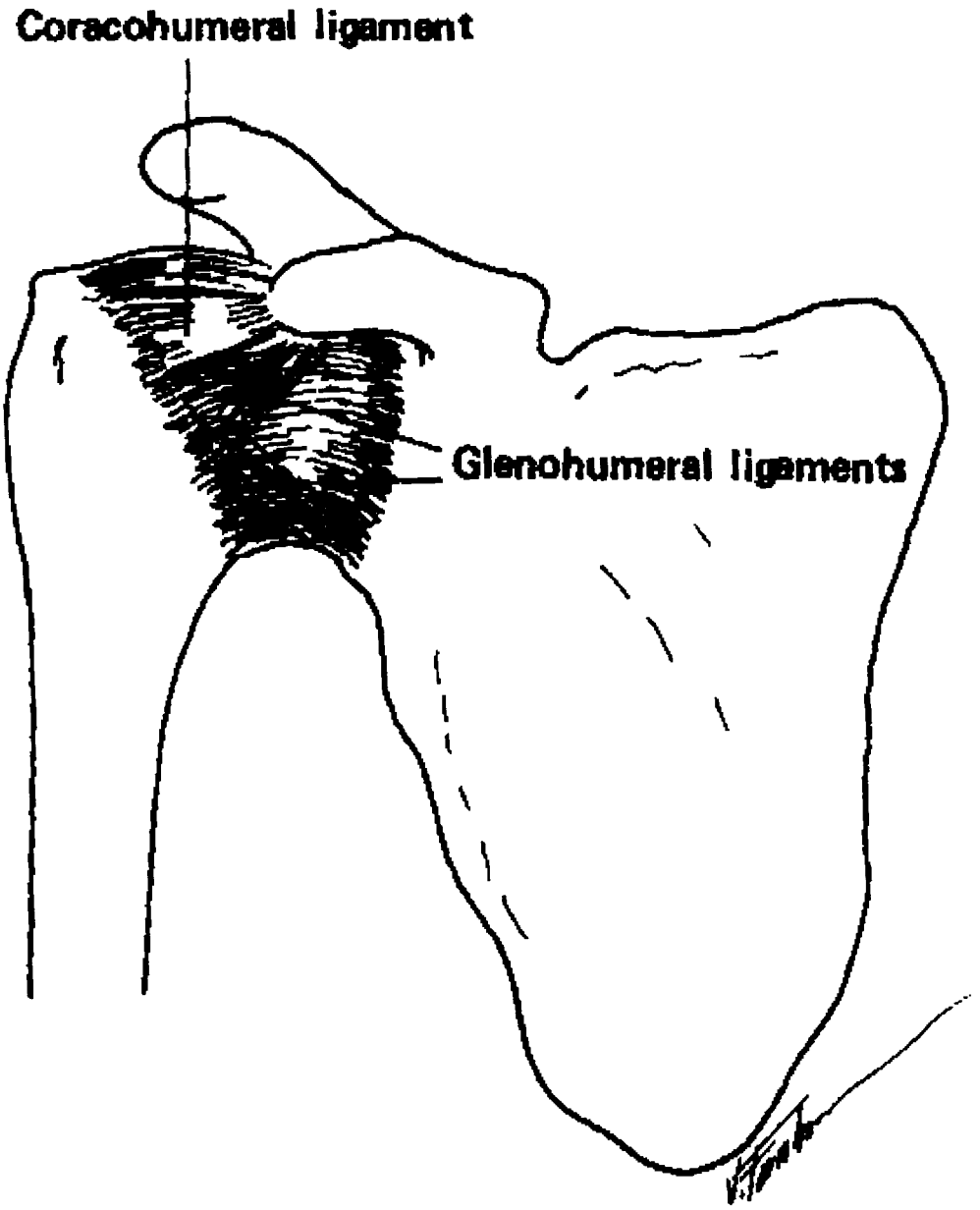
Appendix A

Glenohumeral Joint



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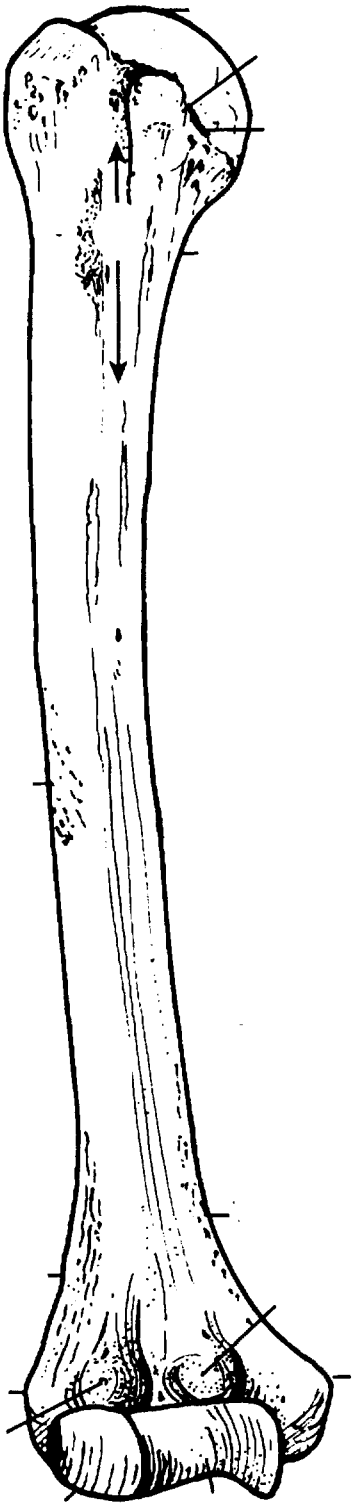
Appendix B

Humerus



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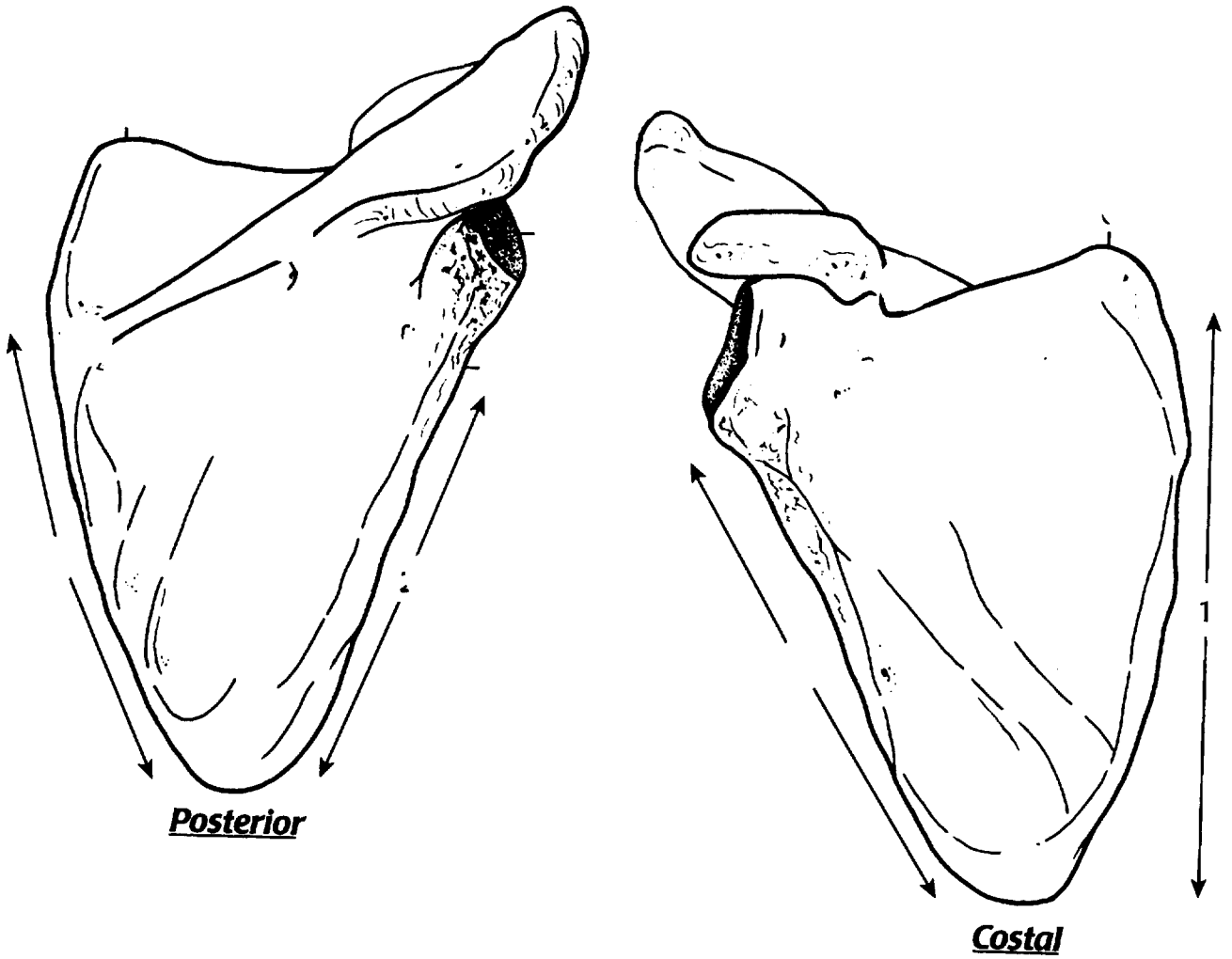
Appendix C

Scapula



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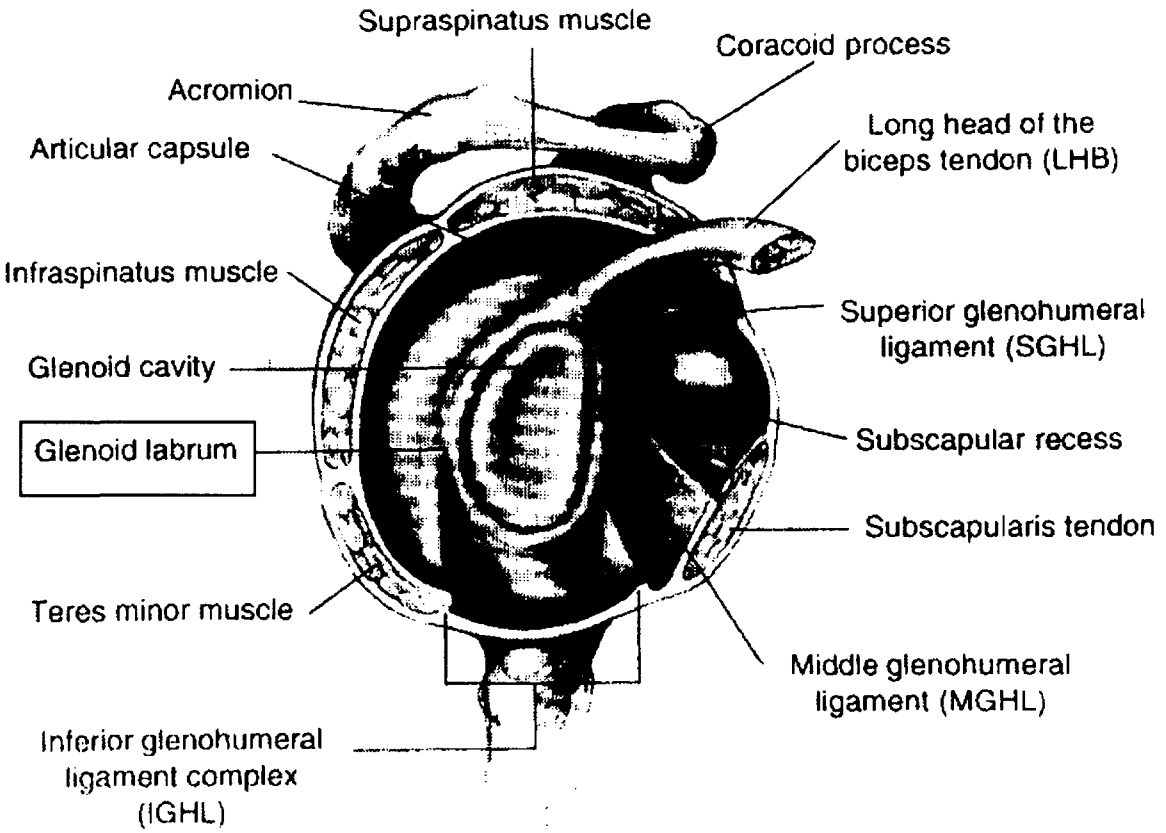
Appendix D

Glenoid Labrum



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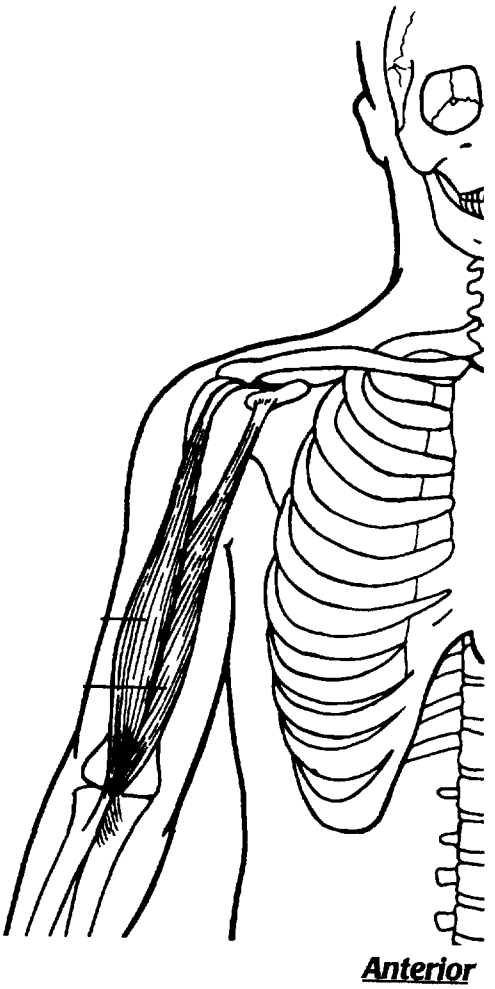
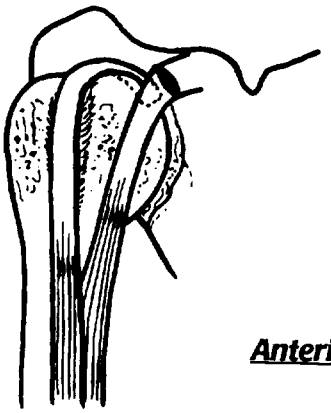
Appendix E

Biceps Tendon





Sieg K, Adams S. *Illustrated Essentials of Musculoskeletal Anatomy 3rd Edition.* Gainesville, FL: Megabooks;1996:25.

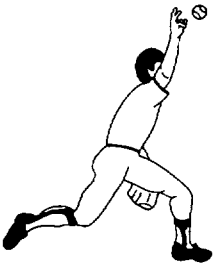
Appendix F

Phases of the Pitching Motion

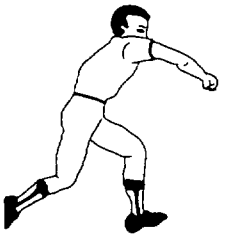
Wind-up

Cocking

Acceleration



Deceleration

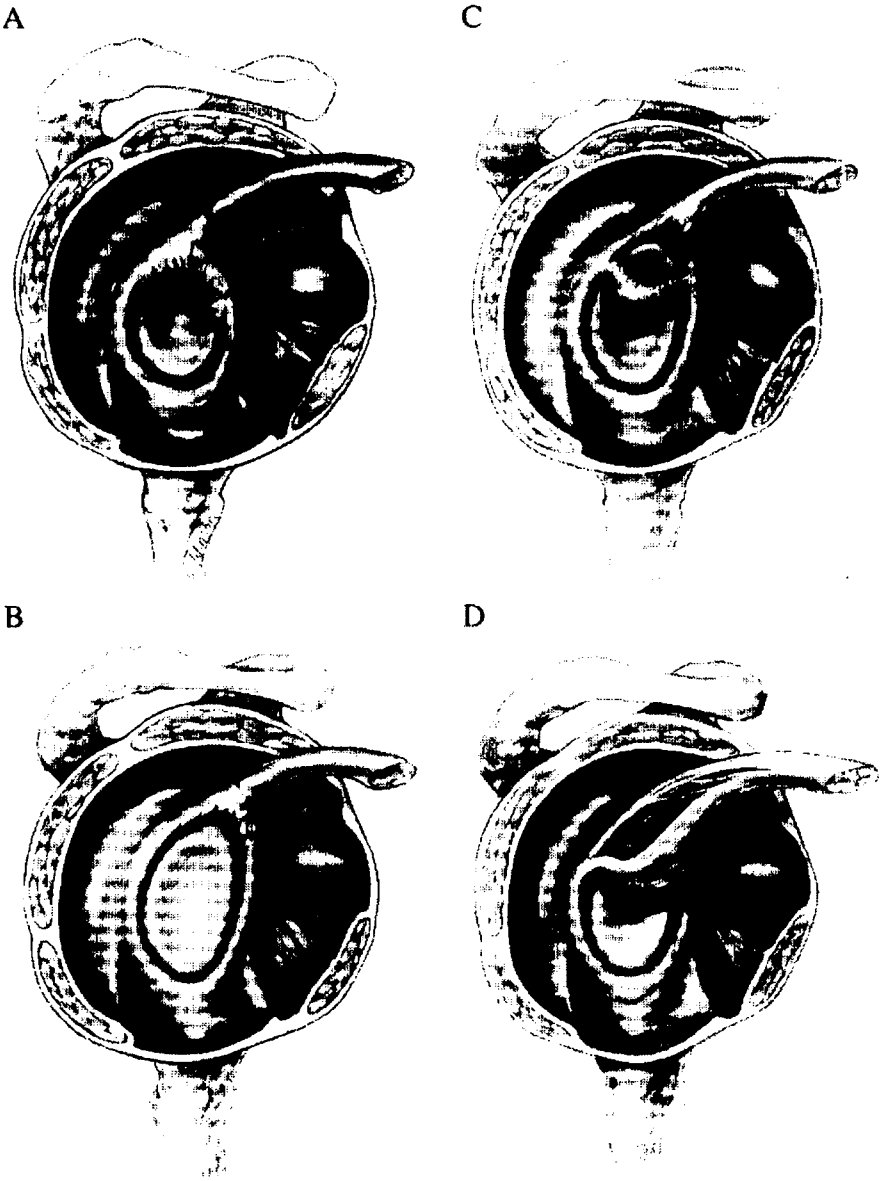


Follow-through

Starkey C, Ryan J. *Evaluation of Orthopedic and Athletic Injuries.* Philadelphia, PA: F.A. Davis Company;1996:333.

Appendix G

SLAP Lesion-Four Distinct Types



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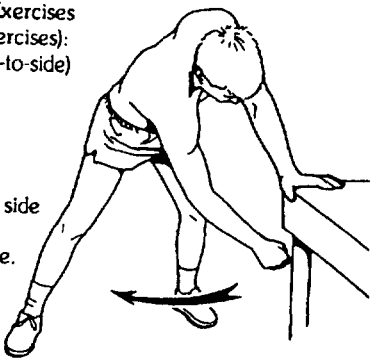
Appendix H

Example of Range of Motion Exercises-Pendulums

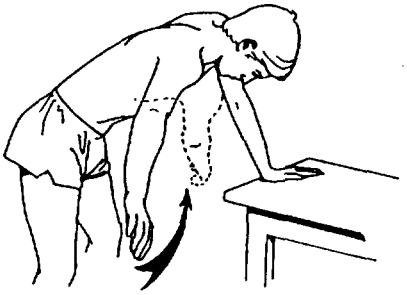
SHOULDER - 25
Range of Motion Exercises
(Codman's Exercises):
Pendulum (side-to-side)



Gently move arm from side to side by rocking body weight from side to side. Let arm swing freely.

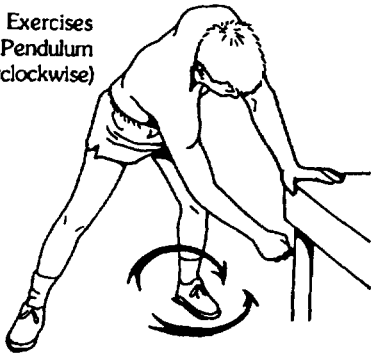
Repeat_____times.
Do_____sessions per day.

SHOULDER - 28 Range of Motion Exercises
(Codman's Exercises): Crosses
(horizontal abduction/adduction)



Supporting body weight with other hand, reach across body as far as you can, then pull back.
Repeat____times. Do____sessions per day.

SHOULDER - 26
Range of Motion Exercises
(Codman's Exercises): Pendulum
(Clockwise/counterclockwise)



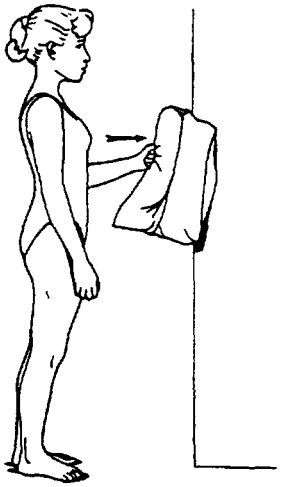
Let arm move in a circle clockwise, then counterclockwise by rocking body weight in a circular pattern.

Repeat_____times.
Do_____sessions per day.

Appendix I

Isometric Exercises

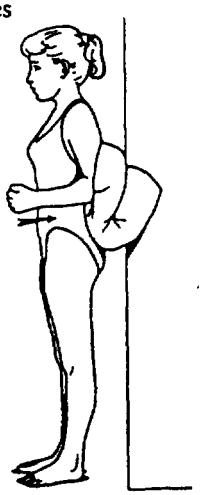
SHOULDER - 29 Strengthening Activities
Isometric Flexion



Using a wall to provide resistance, press fist into wall as shown, using light moderate maximal resistance.

Hold____seconds.
Repeat____times.
Do____sessions per day.

SHOULDER - 31 Strengthening Activities
Isometric Extension



Press back of arm into wall using light moderate maximal resistance.

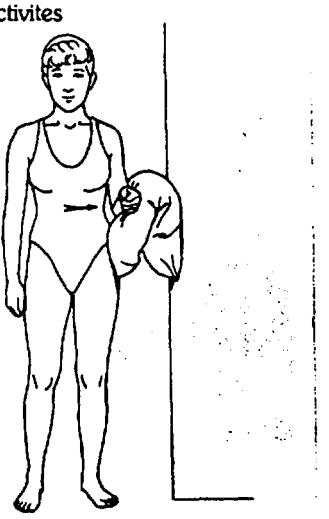
Hold____seconds.
Repeat____times.
Do____sessions per day.

SHOULDER - 34 Strengthening Activities
Isometric Adduction

Gently squeeze pillow using light moderate maximal resistance.

Hold____seconds.
Repeat____times.
Do____sessions per day.

SHOULDER - 32 Strengthening Activites
Isometric Abduction



Using a wall to provide resistance, press into wall with elbow. Use light moderate maximal resistance.

Hold____seconds.
Repeat____times.
Do____sessions per day.

Andrews J, Wilk K. *Rehabilitation Protocol for a SLAP Lesion.* Health South. August 2001.

Appendix J

D1 and D2 Patterns

Figure 13-8 D1 upper-extremity movement pattern moving into extension. Starting position.

Figure 13-9 D1 upper-extremity movement pattern moving into extension. Terminal position.

Figure 13-10 D2 upper-extremity movement pattern moving into flexion. Starting position.

Figure 13-11 D2 upper-extremity movement pattern moving into flexion. Terminal position.

Figure 13-12 D2 upper-extremity movement pattern moving into extension. Starting position.

Figure 13-13 D2 upper-extremity movement pattern moving into extension. Terminal position.

Houglum P. *Therapuetic Exercise for Athletic Injuries.* Champaign, IL: Human Kinetics; 2001:254.

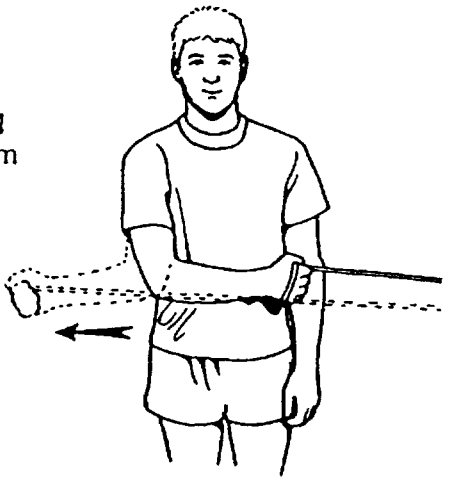
Appendix K

Tubing Exercises

SHOULDER - 43 Strengthening Activities
Active Resistive External Rotation

Using tubing, and keeping elbow in at side, rotate arm outward away from body. Be sure to keep forearm parallel to floor.

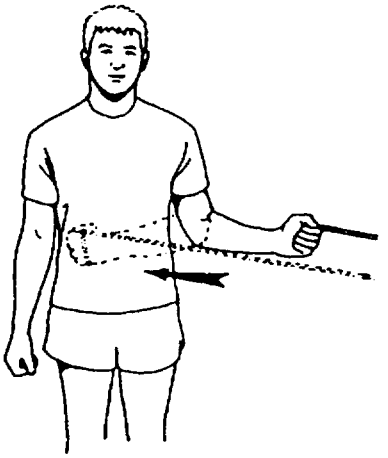
Repeat_____times.
Do_____sessions per day.



SHOULDER - 44 Strengthening Activities
Active Resistive Internal Rotation

Using tubing, and keeping elbow in at side, rotate arm inward across body. Be sure to keep forearm parallel to floor.

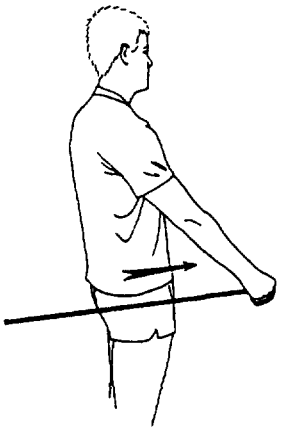
Repeat_____times.
Do_____sessions per day.



Andrews J, Wilk K. *Rehabilitation Protocol for a SLAP Lesion.* Health South. August 2001.

Tubing Exercises

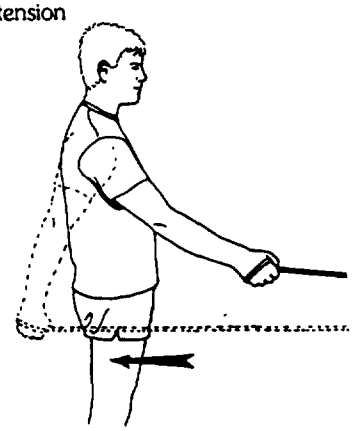
SHOULDER - 41 Strengthening Activities
Active Resistive Flexion



Using tubing, start with arm at side and pull arm outward and upward. Move shoulder through pain free range of motion.

Repeat____times.
Do____sessions per day.

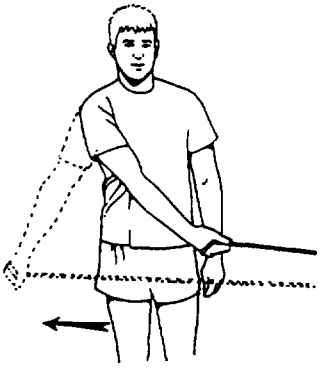
SHOULDER - 45 Strengthening Activities
Active Resistive Extension



Using tubing, pull arm back. Be sure to keep elbow straight.

Repeat____times.
Do____sessions per day.

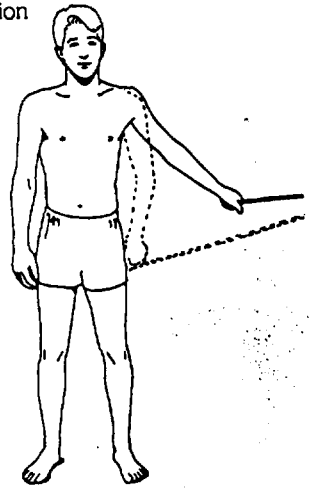
SHOULDER - 42 Strengthening Activities
Active Resistive Abduction



Using tubing, start with arm across body and pull away from side. Move through pain free range of motion.

Repeat____times.
Do____sessions per day.

SHOULDER - 46 Strengthening Activities
Active Resistive Adduction



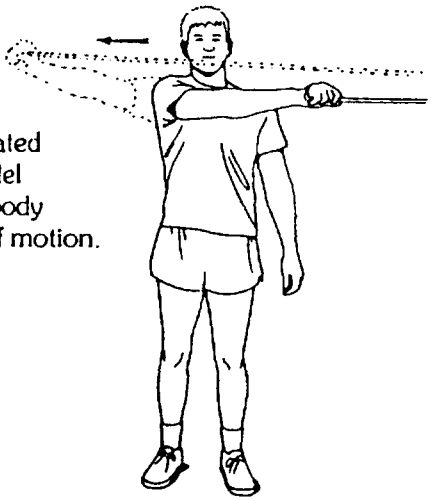
Using tubing, pull arm in toward buttock. Do not twist or rotate trunk.

Repeat____times.
Do____sessions per day.

Andrews J, Wilk K. *Rehabilitation Protocol for a SLAP Lesion.* Health South. August 2001.

Tubing Exercises

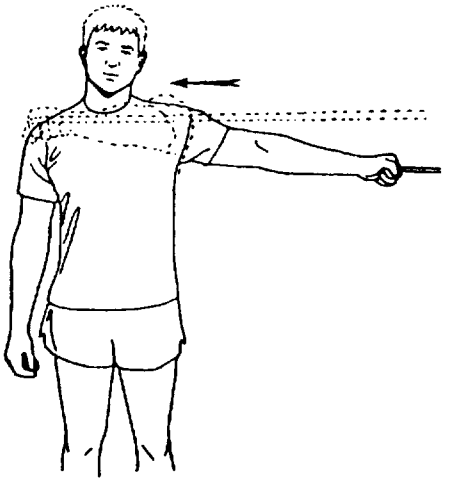
SHOULDER - 47 Strengthening Activities
Active Resistive Horizontal Abduction



Using tubing, keep elbow straight and shoulder elevated so that upper arm is parallel to floor. Pull arm across body through pain free range of motion.

Repeat_____times.
Do_____sessions per day.

SHOULDER - 48 Strengthening Activities
Active Resistive Horizontal Adduction



Using tubing, start with arm elevated, parallel to floor. Bend to 90 degrees and pull arm across body through pain free range of motion.

Repeat_____times.
Do_____sessions per day.

Andrews J, Wilk K. *Rehabilitation Protocol for a SLAP Lesion.* Health South. August 2001.

Appendix L

ROTATOR CUFF PROGRAM
HEALTHY THROWER

1. STANDING EXERCISES:
    A. FORWARD FLEXION (THUMB UP and/or THUMB DOWN)
    B. SIDE FLEXION (THUMB UP and/or THUMB DOWN)
    C. EMPTY and/or OPEN CAN
2. LYING ON STOMACH – FORWARD FLEXION (THUMB UP)
3. LYING ON STOMACH – HORIZONTAL ABDUCTION (PALM DOWN)
4. LYING ON STOMACH – EXTENSION (THEN OUT FROM HIP AND BACK)
5. LYING ON STOMACH – SCAP ADDUCTION WITH EXTERNAL ROTAION
6. SIDE LYING EXTERNAL ROTATION (ELBOW AGAINST HIP –WRIST FLEX)
7. PUSH-UP (ELBOW STRAIGHT–PUSH BACK TO SKY, THEN PINCH SHOULDERS)
8. WRIST FLEXION / EXTENSION
9. FOREARM SUPINATION AND PRONATION

<u>WITH TRAINER</u>

10. PNF PATTERNS (WITH TUBING, IF NOT DOING THEM WITH THE TRAINER)
11. ON YOUR BACK – PUNCHES (USE 10 – 15 POUNDS OR THE TRAINER)

<u>WITH TUBING</u>

12. EXTERNAL ROTATION – **ELBOW AT SIDE <u>AND</u> IN THROWING POSITION**

<u>BALL THROWS</u> *(1 X 30 REPS)*

13. EXTERNAL ROTATION – IN THROWING POSITION
14. EXTERNAL ROTATION – ARM AT SIDE
15. CHEST PASS

**** 2 X 15 ALL EXERCISES WITH 2 – 5 POUNDS (UNLESS OTHER LISTED)
**** STARTERS = EXERCISE DAY AFTER GAME AND ON BULL PEN DAY

OR ONE SET AFTER GAME <u>AND</u> ONE SET AFTER BULL PEN
**** RELIEVERS (OVER 20 PITCHES) = 1 X 15 AFTER GAME
2 X 15 PER YOUR SCHEDULE
**** SHORT RELIEVERS (UNDER 20 PITCHES) = 2 X 15 AFTER GAME

Bibb M. Baltimore Orioles. August 2001.

PITCHERS ROTATOR CUFF PROGRAM

START POSITION

FULL FLEXION

1. Standing with palms down, arms at shoulder width.
2. Lift arms to shoulder height and then lower slowly.
3. Both arms.

START POSITION

FULL FLEXION

SIDE FLEXION

1. Standing with palms down, arms at shoulder width.
2. Lift arms to shoulder height and then slowly lower.
3. Both arms.

START POSITION

FULL FLEXION

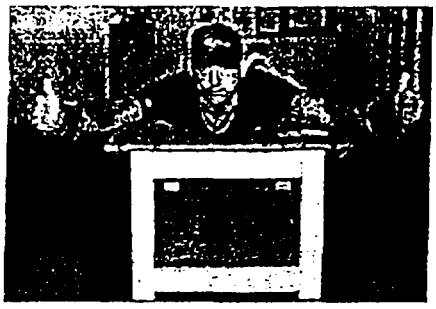
EMPTY OR OPEN CAN

1. Standing with thumbs pointing down (for empty can), and arms at a 45-degree angle.
2. Lift arms to shoulder height.
3. Slowly lower.
4. Both arms.
5. Empty can is shown to the left.
6. Open can is done with the thumbs pointing up.

Bibb M. Baltimore Orioles. August 2001.

ROTATOR CUFF PROGRAM (CONTINUED)

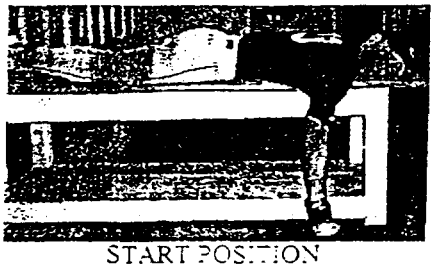
START POSITION



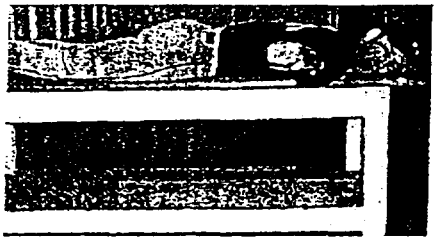
FULL FLEXION

PRONE FORWARD FLEXION

1. Lying on your stomach with your arms at the corners of the table (45 degree angle).
2. Thumbs pointed up, lift above the level of the tab
3. Slowly lower arms.



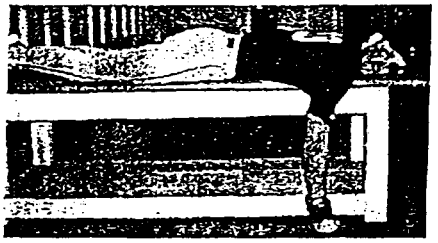
START POSITION



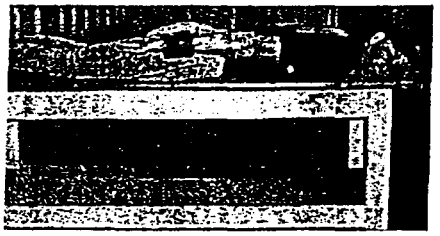
FULL ABDUCTION

HORIZONTAL ABDUCTION

1. Lying on your stomach with your arm moved bac toward your hip.
2. Palm pointed down, lift arm just above height of the table.
3. Return to starting position



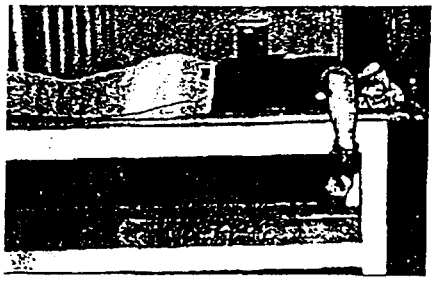
START POSITION



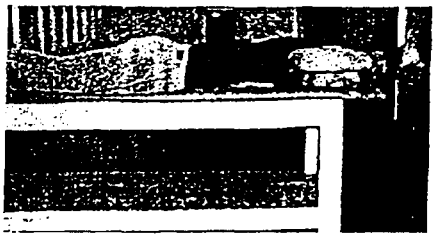
FULL ABDUCTION

EXTENSION W/ ABDUCTION

1. Lying on your stomach with your thumb pointed towards the table.
2. Lift arm straight back, rubbing thumb against your hip and lifting slightl higher than your hip.
3. Pull arm out away from body (3 inches), then back into hip. (Return to start)



START POSITION

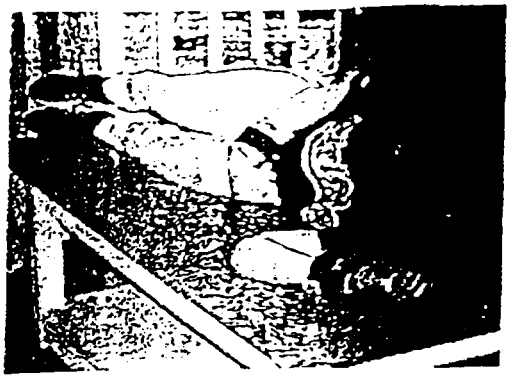


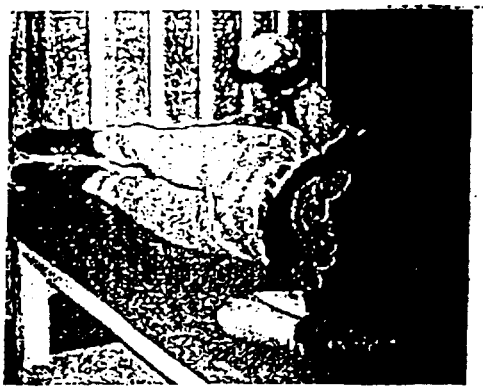
EXTERNAL ROTATION

ROW W/ EXT. ROTATION

1. Lying on stomach with thumb pointed towards table.
2. Lift shoulder up with elbow bent at 90 degrees.
3. With shoulder at 90 degrees, rotate shoulder up and then back down.
4. Return to starting position.

ROTATOR CUFF PROGRAM (CONTINUED)





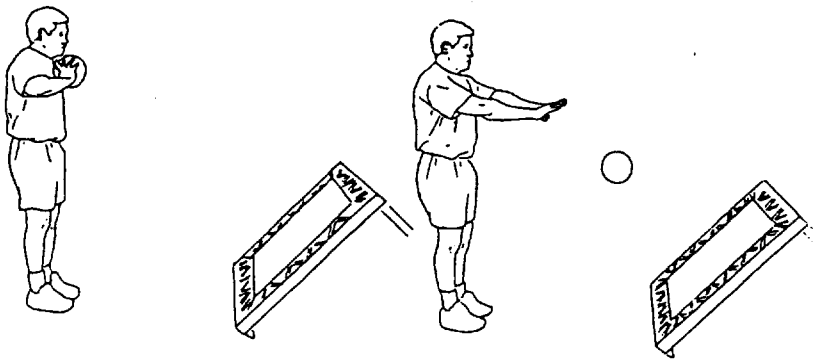
SIDELYING EXT. ROTATION

1. Lying on you non-pitching side.
2. Cock you wrist in towards you forearm; keep your el in towards you side.
3. Externally rotate and retu starting position.

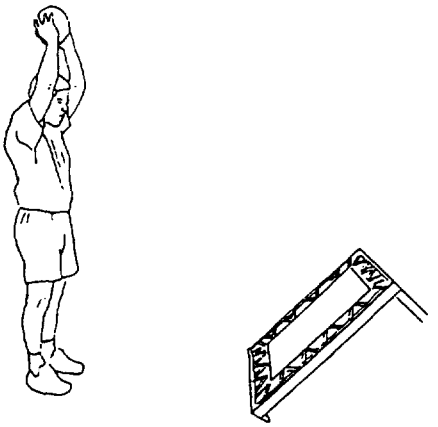
Appendix M

Plyoball and Plyometric Exercises

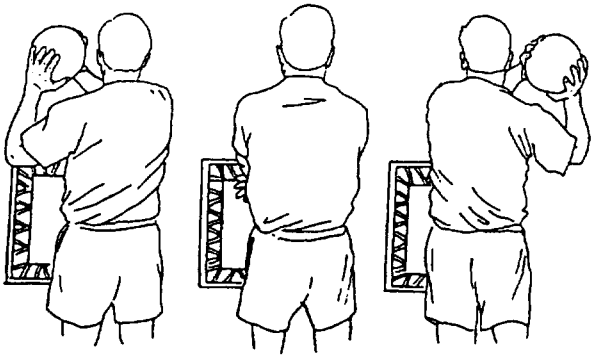
1. Chest Pass:
   Stand facing a plyoback. Use both hands to hold a 3 lb. medicine ball against the chest. Push the ball away from the chest into the plyoback. Allow ball to return to starting position as you catch it. Perform _____ sets _____ repetitions.



2. Two hand overhead soccer throw:
   Stand or kneel facing a plyoback. Hold a 3-5 lb medicine ball in both hands. Raise the ball overhead; then throw it into the plyoback. Catch the ball overhead as it rebounds. Perform _____ sets of _____ repetitions.

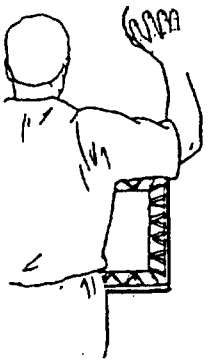


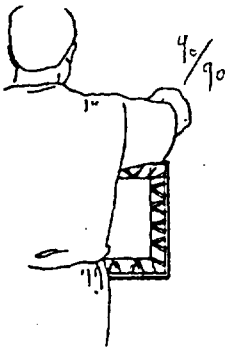
3. Two-hand side-to-side throw:
   Stand facing a plyoback. Hold a 3-5 lb medicine ball with both hands, positioned over one shoulder. Throw the ball into the plyoback; then catch it with both hands over the opposite shoulder. Continue alternating sides. Perform _____ sets of _____ repetitions. This exercise can also be used to train the rotators of the hips and trunk by allowing the body to rotate slightly as the ball is caught.



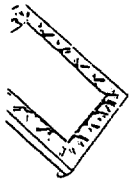
Andrews J, Wilk K. *Rehabilitation Protocol for a SLAP Lesion.* Health South. August 2001.

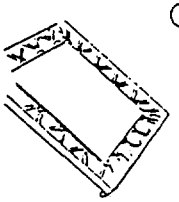
Plyoball and Plyometric Exercises



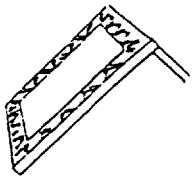


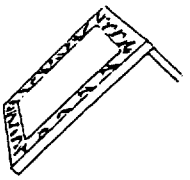
arm at a 90 degree angle away from the body and the elbow bent to 90 degrees (cocking position). Hold a 1 lb medicine ball. Forcefully throw the ball into the plyoback; then catch it as it rebounds, maintaining the same position of the arm and elbow. Perform _____ sets of _____ repetitions. This exercise can also be used to train the legs and trunk to accelerate the arm by stepping out as the ball is thrown.





5. Backhand ER at 0 degrees:
Stand sideways with the involved side toward the plyoback and a 1-3 lb medicine ball in the involved hand. Keep the upper arm against the body and bend the elbow to 90 degrees. Rotate the arm in toward the chest; then forcefully rotate out, throwing the ball into the plyoback. Try to catch the ball as it rebounds with the palm towards the body and upper arm close to side. Perform _____ sets of _____ repetitions.





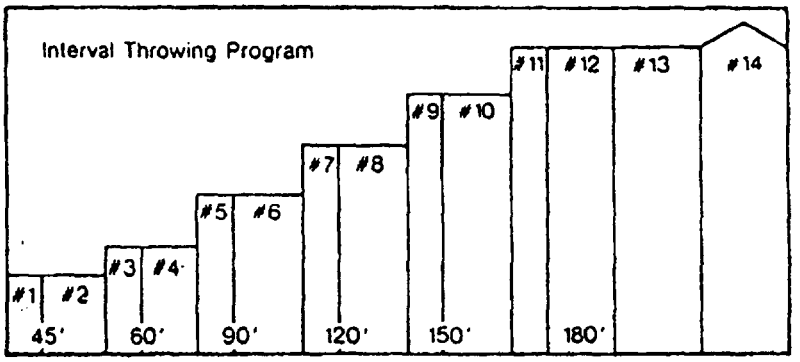
6. Backhand IR at 0 degrees:
Stand sideways with the uninvolved side nearest the plyoback and a 1-3 lb medicine ball in the involved hand. Keep the upper arm of the involved side close to the body and the elbow bent to 90 degrees. Allow the arm to rotate out; then forcefully throw the ball into the plyoback. Catch the ball while maintaining the upper arm against the body. Perform _____ sets of _____ repetitions.

7. Wall dribble:
Stand facing a wall. Hold a 1-3 lb medicine ball slightly above shoulder level. Dribble the ball against the wall. Perform _____ sets of _____ seconds each. This exercise can be progressed by dribbling the ball in an arch along the wall.

Andrews J, Wilk K. *Rehabilitation Protocol for a SLAP Lesion.* Health South. August 2001.

Appendix N

Interval Throwing Program



45' Phase

Step 1: A) Warm-up throwing
B) 45' (25 throws)
C) Rest 15 minutes
D) Warm-up throwing
E) 45' (25 throws)

Step 2: A) Warm-up throwing
B) 45' (25 throws)
C) Rest 10 minutes
D) Warm-up throwing
E) 45' (25 throws)
F) Rest 10 minutes
G) Warm-up throwing
H) 45' (25 throws)

60' Phase

Step 3: A) Warm-up throwing
B) 60' (25 throws)
C) Rest 15 minutes
D) Warm-up throwing
E) 60' (25 throws)

Step 4: A) Warm-up throwing
B) 60' (25 throws)
C) Rest 10 minutes
D) Warm-up throwing
E) 60' (25 throws)
F) Rest 10 minutes
G) Warm-up throwing
H) 60' (25 throws)

90' Phase

Step 5: A) Warm-up throwing
B) 90' (25 throws)
C) Rest 15 minutes
D) Warm-up throwing
E) 90' (25 throws)

Step 6: A) Warm-up throwing
B) 90' (25 throws)
C) Rest 10 minutes
D) Warm-up throwing
E) 90' (25 throws)
F) Rest 10 minutes
G) Warm-up throwing
H) 90' (25 throws)

120' Phase

Step 7: A) Warm-up throwing
B) 120' (25 throws)
C) Rest 15 minutes
D) Warm-up throwing
E) 120' (25 throws)

Step 8: A) Warm-up throwing
B) 120' (25 throws)
C) Rest 10 minutes
D) Warm-up throwing
E) 120' (25 throws)
F) Rest 10 minutes
G) Warm-up throwing
H) 120' (25 throws)

150' Phase

Step 9: A) Warm-up throwing
B) 150' (25 throws)
C) Rest 15 minutes
D) Warm-up throwing
E) 150' (25 throws)

Step 10: A) Warm-up throwing
B) 150' (25 throws)
C) Rest 10 minutes
D) Warm-up throwing
E) 150' (25 throws)
F) Rest 10 minutes
G) Warm-up throwing
H) 150' (25 throws)

180' Phase

Step 11: A) Warm-up throwing
B) 180' (25 throws)
C) Rest 15 minutes
D) Warm-up throwing
E) 180' (25 throws)

Step 12: A) Warm-up throwing
B) 180' (25 throws)
C) Rest 10 minutes
D) Warm-up throwing
E) 180' (25 throws)
F) Rest 10 minutes
G) Warm-up throwing
H) 180' (25 throws)

Step 13: A) Warm-up throwing
B) 180' (25 throws)
C) Rest 10 minutes
D) Warm-up throwing
E) 180' (25 throws)
F) Rest 10 minutes
G) Warm-up throwing
H) 180' (50 throws)

Step 14: Begin throwing off the mound or return to respective position

Bibb M. Baltimore Orioles. August 2001.

Appendix O

Flat-Ground Throwing

Rotation Drill is done at 45 ft.

Throwing to second player in a squat

Warm up throwing should be done prior to rotation drill 45 – 120 feet

Rotation drill should be used with long toss program, prior to mound work.

Fastballs: 3 middle, 3 in, 3 out = 9 Pitches

Change-up: Throw for strike = 5 pitches

Curveball or Slider: Throw for strike = 5 pitches

Fastball and Change up routine: 5 sets = 10 pitches (1 FB on 1 CH for strike - repeat 5 times)

Putaways: RHP > Fastball in, Breaking ball away (To right handed hitter) 2 sets = 4 pitches
Fastball in, Change up down (To left handed hitter) 2 sets = 4 pitches

OR

LHP > Fastball in, Breaking ball away (To left handed hitter) 2 sets = 4 pitches
Fastball in, Change up down (To right handed hitter) 2 sets = 4 pitches

3 – 0 count: = 3 pitches

TOTAL PITCHES = 40

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Mound Throwing

Phase II

STAGE ONE: FASTBALL ONLY

Step 1: Interval Throwing
15 Throws off mound 50%

(use interval throwing to 120' Phase as warm-up)

Step 2: Interval Throwing
30 Throws off mound 50%

Step 3: Interval Throwing
45 Throws off mound 50%

ALL THROWING OFF THE MOUND SHOULD BE DONE IN THE PRESENCE OF YOUR PITCHING COACH TO STRESS PROPER THROWING MECHANICS.

Step 4: Interval Throwing
60 Throws off mound 50%

Step 5: Interval Throwing
30 Throws off mound 50%

(Use speed gun to aid in effort control.)

Step 6: 30 Throws off mound 75%
45 Throws off mound 50%

Step 7: 45 Throws off mound 75%
15 Throws off mound 50%

Step 8: 60 Throws off mound 75%

STAGE TWO: FASTBALL ONLY

Step 9: 45 Throws off mound 75%
15 Throws in Batting Practice

Step 10: 45 Throws off mound 75%
30 Throws in Batting Practice

Step 11: 45 Throws off mound 75%
45 Throws in Batting Practice

STAGE THREE

Step 11: 30 Throws off mound 75% warm-up
15 Throws off mound 50% BREAKING BALLS
45-60 Throws in Batting Practice (fastball only)

Step 12: 30 Throws off mound 75%
30 Breaking balls 75%
30 Throws in Batting Practice

p 13: 30 Throws off mound 75%
60-90 Throws in Batting Practice 25% Breaking balls.

Step 14: SIMULATED GAME: PROGRESSING BY 15 THROWS PER WORK-OUT.

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